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TECHNOLOGY DEPT.

SCIENCE NEWS LETTER

THE WEEKLY SUMMARY OF CURRENT SCIENCE • FEBRUARY 9, 1946

Blood-Cell "Footprints"

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A SCIENCE SERVICE PUBLICATION

MEDICINE

St. Louis Virus Isolated

Sleeping sickness germ found in California for first time. Definite evidence that fowl are the main reservoir of the disease.

➤ WITH THE ISOLATION for the first time of the St. Louis encephalitis virus in California and definite evidence that fowl are the main reservoir of the disease, scientists are fitting together the pieces of what may become a general pattern for this so-called sleeping sickness in the Western states.

Scientists in the Hooper Foundation for Medical Research at the University of California Medical School isolated the St. Louis type virus from a common type mosquito caught in Kern County. It had been generally conceded that the virus was present, but definite proof had been lacking previously.

Hooper researchers Dr. W. C. Reeves and Dr. W. McD. Hammon have found the following sleeping sickness pattern:

Fowl, both domestic and wild, are the principal reservoirs of the virus. Mosquitoes, especially the common species, *Culex tarsalis,* feed on the fowl, then bite horses and man. Preference for the fowl makes the barnyard an excellent reservoir, and biting of man and horses causes occasional sharp epidemics in Western states.

This pattern has repeated itself in two major studies of epidemics, one in the Yakima Valley, Wash., 1941-43, and the other in Kern County, Calif., which occurred in 1943. The latter study is still not completed.

In both studies the investigators collected thousands of mosquitoes, ticks, fleas, lice, flies, kissing bugs and bedbugs. Examination of the stomach contents of these specimens showed that only mosquitoes were infected with the virus and that they had fed on fowl.

While the virus produces no disease in fowl, it does cause serious illness in both horses and man, affecting the nervous system and sometimes causing damage to the brain.

Vaccination is effective, but is not recommended on a mass scale, because the incidence of the disease is so low.

Horse encephalitis, of both the western and St. Louis type, is confined in the West ordinarily to hot valleys, and it occurs in man mainly in rural areas and the suburbs of large cities where chickens are kept.

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ASTRONOMY

New Giant Prominence

May have been discovered on one component of the double star Zeta Aurigae. May be nearly as large as the sun itself, Dr. Kopal states.

➤ A GIANT PROMINENCE, similar to the huge flame-like clouds of gas seen erupting from the surface of the sun, may have been discovered on one component of the double star Zeta Aurigae, according to a paper presented at the American Astronomical Society meeting in New York by Dr. Zdenek Kopal, of Harvard College Observatory. The huge cloud of gas is sufficiently dense to almost completely hide the light of a smaller bright companion star. It may be nearly as large as the sun itself.

Three times in about eight years, the blue-white B member of this double star is eclipsed by its giant red companion. Preceding and following the total phase, during which the B or helium star is invisible behind the large red K member, the B star undergoes a series of partial obscurations behind portions of the immense atmosphere around the K star. This atmosphere, which is as thick as one-fifth the diameter of the larger star, is in several layers, and a regular sequence of changes occurs as the B star passes behind these layers successively.

In the eclipse of December 18, 1939, to January 28, 1940, however, the blue star was obscured by a huge cloud about one million kilometers wide, which Dr. Kopal interprets as a huge stellar prominence. The light-curve of changes during this eclipse was very peculiar, and the Harvard astronomer thinks it was just a matter of chance that the fainter star passed behind this particular "prominence" in its primary's atmosphere. This rare event may not occur again for several cycles, so he suggests very careful observations of future eclipses of Zeta Aurigae to see how often this phenomenon repeats itself.

Among these same lines, spectroscopic analysis of the weaker lines in the spectra of the star Arcturus and of the star 70 Ophiuchi A, made by Suzanne E. A. van Dijke, National Research Fellow at Mount Wilson Observatory, show the relative differences between these stars. Arcturus is a giant orange star, while 70 Ophiuchi is a dwarf of the same type. Stratification of elements in the atmosphere of the giant star was found to be similar to the layer arrangement in the atmosphere of the sun. Thus, the solar atmosphere appears to be a prototype of stellar atmospheric structure, although on a smaller scale than in giants like Arcturus and Zeta Aurigae.

Nevertheless, work at the Leander McCormick Observatory of the University of Virginia, reported by Emma T. R. Williams and A. N. Vyssotsky, indicates that stars are not all of the same genesis. These investigators have found that red giant stars appear to form a more spherical system of stars in the Milky Way galaxy than do normal white A-type stars.

"Red giants," said Dr. Vyssotsky, "seem to conform to a very different code of laws from those governing A-type stars. The red giants are mostly nearer the galactic center, but distributed farther from its plane, so they form a more spherical system than do the A stars, which hug the plane but spread out well beyond the sun's distance from the center."

This work on stars in our own galaxy gives results similar to those procured by Dr. Walter Baade, of Mount Wilson Observatory, for the exterior galaxy, M33, in Triangulum, one of the nearest of other stellar systems. Dr. Baade found that the red giants of M33 are highly concentrated towards the central spheroid, whereas the A-type and other white stars are characteristic of the arms. Dr. Vyssotsky pointed out this similarity to his own results.

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PHYSICS

New Gas in Atmosphere

Sun photographs detect the presence of nitrous oxide close to the earth. May result from slow decomposition of fertilizers in farming areas.

➤ THE EXISTENCE of the gas, nitrous oxide, in the earth's atmosphere in sufficient quantity to record on spectrum photographs of the sun has been established by Dr. Arthur Adel, of the Randall Laboratory of Physics, University of Michigan. He reported his work before the meeting of the American Astronomical Society in New York.

Dr. Adel has discovered and analyzed an absorption band at wavelength 7.77 mu in the infra-red photographic spectrum of the sun. This is a "telluric" band, which means that it is put into the spectrum by the selective absorption of sunlight as it passes through the earth's atmosphere. Telluric lines, such as those of oxygen and carbon dioxide, are easily recognized in most cases because they do not show the Doppler shift shared by lines originating in the sun's atmosphere and partaking of the sun's rotation and other apparent motions.

In recent examinations of soil air, M. W. Kriegel, of the Carter Oil Company, Tulsa, Okla., has found a gas which he believes to be nitrous oxide, and he suggests that this may result from the slow decomposition of commercial fertilizers in farming areas, since nitrogen is the common element in ammonium salts, nitrites, nitrates, and other fertilizers. Decomposing vegetable matter under aerobic conditions also gives off a gas having the properties of nitrous oxide. Dr. Adel suggests that soil air is thus probably the chief source of the "layer" of atmospheric nitrous oxide.

Better Infra-Red Photos

➤ THE NITROUS oxide band at 7.7 mu is far out in the infra-red region of the spectrum—at 77,000 Angstroms. Observations of the spectra of the stars have not extended out nearly this far, but Dr. W. F. Swann, of Eastman Kodak Company, Rochester, N. Y., reported to the astronomical meeting that astronomical spectroscopic plates had received much improvement during the war, and that within the past year Mount Wilson Observatory has succeeded in obtaining spectra beyond 11,000 Angstroms of some of the brighter stars.

Dr. Swann reported an increase in the sensitivity of Type IZ, an infra-red emulsion, of five times; he also noted that Type 649-GH spectroscopic plate is capable of resolving more than 1,000 lines per millimeter, making it very useful for making reticles and graticules. The industrial applications of this film are widespread.

Lost Sun-Star

➤ THE DISCOVERY of a "dark" companion star to the brightest star in the constellation of Ophiuchus, was reported by Dr. Nicholas E. Wagman, acting director of Allegheny Observatory, University of Pittsburgh. Preliminary estimates indicate that the companion of Alpha Ophiuchi is a star similar to the sun, but because the brighter star outshines it 20 times, its light is lost in the glare. This companion appears to be moving about the bright primary star at a distance seven times that of the earth from the sun, in a period of about 8½ years. The presence of the faint companion is determined by its effect on the motion of the bright star, which appears to pursue a wavy path across the sky.

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ARCHAEOLOGY

Easter Island Relics Only a Few Centuries Old

➤ THE GREAT, gaunt stone faces that stare sightlessly over the ocean from the slopes of lonely Easter island in the South Pacific are not the last relics of a great civilization, drowned by a continental catastrophe thousands of years ago, declares Dr. Alfred Métraux, Smithsonian Institution anthropologist. Although their origin remains veiled in mystery, the best evidence he has been able to muster indicates that they are almost certainly less than 800 years old, possibly not more than 500 or 600.

Dr. Métraux points out that although the huge images are made of soft stone and stand where heavy rains beat and the ceaseless wind works on them night and day, they are relatively little weathered. Their outlines are still sharp and hammer marks are plainly visible. If they were as old as romantic accounts would have them, they would be much more severely weathered.

NOT SO OLD—This Easter Island man in the Hall of Fame at the American Museum of Natural History is almost certainly less than 800 years old.

Dr. Métraux has also attempted to solve the riddle of the figure-inscribed pieces of wood found on the island. He is convinced that the inscriptions are not true writing, and that they have no relation to 5,000-year-old stone tablets covered with hieroglyphics that have been found in India, and which they are said to resemble. After testing and discarding several hypotheses, he regards as most probable the idea that these inscribed slabs represent a special type of "orator staff," a badge of office used by tribal story-tellers elsewhere in Polynesia.

Easter island itself is not a last surviving mountain-peak of a sunken continent, Dr. Métraux is convinced. Soundings show that it is the emerged top of an isolated submarine volcano, standing alone on a monotonously level ocean floor. The Polynesian ancestors of the present inhabitants came there in canoes, probably about the twelfth or thirteenth century A.D.

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Chinook *salmon* spawn, usually, only in water below 54 degrees Fahrenheit.

ASTRONOMY

Only 11 Billion Galaxies

New 200-inch telescope, when completed, expected to furnish data for test of new theory of relativity which reduces population of the universe.

➤ THE 200-INCH telescope is expected to furnish observing data for a critical test of a new theory of relativity which cuts down the population of the universe to only about 11 billion galaxies. This theory, proposed by the late Dr. George D. Birkhoff, of Harvard University, has been applied to the dynamics of the universe by Sr. Luis Enrique Erro, director, and Dr. Carlos Graef, assistant director, of the Mexican Astrophysical Observatory at Tonanzintla, in the State of Puebla, Mexico.

In three papers given at the meeting of the American Astronomical Society in New York, they present the results of their computations and point out that counts of remote star systems, so faint as to be seen only by the Mount Palomar telescope, are needed to give observational proof of the correctness of the Birkhoff theory.

The new theory predicts, according to Sr. Erro and Dr. Graef, a uniformly expanding universe, which began this expansion about 2,000 million years ago, in agreement with the "short time-scale" of the universe. The analysis satisfactorily accounts for observations of the red shifts in the spectra of galaxies and for their distribution in space as determined with the 100-inch telescope at Mount Wilson and by researches at Harvard College Observatory. The limit of the 100-inch instrument is the 21st magnitude (photographic), whereas Sr. Erro has been able to predict the distribution of galaxies as faint as magnitude 23.5, the probable limit of the 200-inch telescope. It is for these very remote galaxies, whose light spends up to 1,000 million years reaching us, that the predicted counts on the basis of the Birkhoff theory differ notably from the predictions of other theories, notably those developed by Dr. Edwin P. Hubble, of Mount Wilson Observatory.

Dr. Hubble's studies have led to two rather puzzling dilemmas. If the assumption is made that the universe is in expansion in the sense predicted by Einstein-Lemaître relativity, the red shifts seem to vary as if the universe were slowing its rate of expansion. Its age then seems to be only about 1,000 million years, only half the short time-scale and probably only half the age of the earth. The Birkhoff theory predicts uniform expansion and twice the age.

The second Hubble dilemma concerns the numbers of galaxies actually observed, and indicates a very small, crowded universe with positive space curvature. Birkhoff's theory leads to a less crowded universe, with a set of corrections to be applied to the magnitudes of the most distant galaxies different from those required by Einstein-Lemaitre theory.

"The all-important point in Birkhoff's theory is his central postulate of four-dimensional flat space as the geometric frame of cosmic events," Sr. Erro said. "To my way of thinking, it is a return to Newtonian dynamics, although the Birkhoff theory retains all the assumptions of special relativity proposed by Einstein in 1905. Einstein's general theory is an attempt to substitute geometry for dynamics. Instead of gravitational 'forces' acting upon mass points, the concept of space curvature is introduced. Birkhoff returns to the concept of 'force' and to the implicit Newtonian postulate of flat space."

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BIOCHEMISTRY

Rutin To Go Into Full Scale Production This Year

➤ RUTIN, a drug effective in reducing the increased fragility of small blood vessels which may lead to blinding or fatal hemorrhages in cases of high blood pressure, will go into full scale commercial production this year, the U. S. Department of Agriculture has announced.

Discovery by the department's scientists that the green buckwheat plant is an economical source of the drug, following a two-year search for such a plant, makes possible the commercial manufacture of rutin which is described as a bright yellow, non-toxic powder.

The marked similarity of rutin's chemical structure to that of vitamin P, known for its effect on the fragility of small blood vessels, intrigued the interest of Dr. James F. Couch of the Department's Eastern Regional Research Laboratory. Following his suggestion, medical studies of rutin were made by Dr. J. Q. Griffith, Jr., of the University of Pennsylvania.

Results of his studies and those of about 100 other physicians gave further evidence, the department states, "of the value of rutin for reducing increased capillary fragility and showed that thiocyanates and other drugs for reducing high blood pressure can be used safely after treating with rutin."

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Approximately one-fourth of the *deaf* have deaf relatives.

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ASTRONOMY

Astronomy Meetings

Executive Committee of the International Astronomical Union will convene at Copenhagen in March. Soviet and U. S. each to send three delegates.

➤ THE EXECUTIVE Committee of the International Astronomical Union, which had suspended activities for the duration of the war, will convene at Copenhagen on March 7. The three American delegates will be Dr. Otto Struve, director of the Yerkes and McDonald Observatories of the Universities of Chicago and Texas; Dr. Joel Stebbins, director of the Washburn Observatory of the University of Wisconsin and research associate of the Mount Wilson Observatory; and Dr. Harlow Shapley, director of the Harvard Observatory and president of the American Section of the International Astronomical Union.

Soviet astronomers look forward with great interest to the opening of the conference as the first practical measure for the restoration of international cooperation in science, according to a cablegram to *Science Service* from Prof. Gregory Neuimin, director of the famous Pulkovo Observatory near Leningrad. The Soviet Union will be represented by three delegates, Prof. Neuimin reports. He adds that Soviet astronomers are drawing up a number of proposals on the organization of scientific work and the participation of the Soviet Observatory in international undertakings.

The Conference in Copenhagen, Prof. Neuimin continues, will be attended by 20 astronomers from the ten most important countries in astronomical research. Some of the proposals that will be presented by the Soviet astronomers are the organization of an international center in Russia for the study of variable stars, and the participation of Russia in the renewed work of the Bureau, formerly centered in Germany, for the study of minor planets. At the Conference the Soviet delegates will report on the joint work of Soviet observatories in a compilation of a catalogue of faint stars, Prof. Neuimin states. They will also propose to foreign observatories that they participate in this work on faint stars; and they will submit also a number of other proposals on the organization of the international time service, the publication of astronomical annuals, etc.

The Pulkovo Observatory, of which Prof. Neuimin is director, was completely destroyed by German bombardments and bombs during the siege of Leningrad. Some of the library and a few of the astronomical lenses were taken from Observatory Hill and buried. Some of the other Russian observatories were also destroyed or badly damaged and it is now the plan of the Soviet government to restore all of the astronomical equipment and improve its quality and increase its quantity.

The plans for renewal of international work in astronomy were formulated on Pulkova Hill in June, 1945, when Dr. Harold Spencer Jones, Astronomer Royal of England, and Dr. Harlow Shapley were in Russia as guests of the Soviet Academy of Sciences.

The scope of research work now confronting astronomers, Prof. Neuimin stated in the cablegram, insistently demands cooperation and coordination of the comparatively few scientific institutions and individual scientists working in this field. Need for an international organization of astronomers as early as the 18th century led to the formation of a more or less stable international union to carry out tasks that are beyond the power of one observatory or even of all observatories of one country.

This tendency found more complete expression after the first World War when the International Astronomical Union was formed. A number of countries represented by their academies of sciences or by scientific committees entered the Union. The purpose of the Union is to coordinate and organize astronomical work in all its branches. Every three years the Union convenes a congress where past work is summed up and future tasks outlined.

The USSR joined the International Astronomical Union in 1935 and was represented at the following and last congress held in Stockholm in 1938. Germany didn't deem it necessary to join the union.

FOR BALANCING—Stroboscopic light played an important part in the exact balancing of rotating parts in the Norden Bombsight where tolerances were kept within 20 millionths of an inch. Timed light flashes permitted precise determination of rotating speeds and visual study of imbalance during laboratory tests. In the picture is a technician in the laboratory of the Victor Adding Machine Company using a General Radio Strobotac and a Gisholt Dynetric Balancer.

The work of the International Astronomical Union was brought to a standstill by the war. Observations were continued as far as possible at observatories that escaped destruction, but contact even between scientists of Allied countries was at best sporadic.

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CHEMISTRY

Concrete from Coral

Method using water from the ocean has promising uses for construction on coral islands without other rock or fresh water.

➤ GOOD QUALITY concrete was successfully made during the war with coral and sea water, it is now reported. This was done on Bermuda, where fresh water for the purpose was not available and where there is none of the ordinary rock usually employed in concrete making. A chemical compound added to the cement-coral mixture reduced water requirements and helped control the mix while setting.

The discovery of the method of making concrete satisfactory for construction purposes from coral and sea water is important now because the United States may find it necessary to build naval and other facilities on other coral islands without ordinary rock. It will mean a great saving in transportation costs if local coral is used instead of crushed rock shipped many miles from continental sources of supply.

Coral, rich in calcium, is the skeleton structure created by tiny marine animals known as polyps. It is filled with tiny holes and is highly water-absorbent as well as light in weight. Aggregates made with it would have moisture-retaining properties which might cause dangerous rusting in steel reinforcing rods.

The story of the use of concrete from coral and sea water in Bermuda is told in *Industrial and Engineering Chemistry*, an official publication of the American Chemical Society. Bermuda has plenty of coral but none of the ordinary American varieties of rock. It has no fresh water except the rainwater caught on roofs and run into reservoirs. In spite of the lack of rock and fresh water, concrete was a military necessity for bases for the armed forces on this island.

The decision was made to experiment with local materials. The National Bureau of Standards and the cement industry had conducted research on the use of sea water for mixing concrete. It had been found that sodium and other chlorides would not induce corrosion. Sulfides might, but these were present only in very small quantities.

Cement and water provide the mortar or binder which fills the spaces when stone and sand are mixed in concrete making. The engineers in Bermuda obtained a considerable reduction in the water-cement ratio by using a pozzolanic (volcanic ash) compound in the mixture. Chemically the compound used was calcium lignosulfonate. Its use reduced water requirements by about 17%, and resulted in a concrete that tested over 4,000 pounds per square inch in strength.

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PHYSICS

Thermometers Measure Speed of Jet Planes

➤ THE USE of thermometers to measure speeds of supersonic jet planes and other high-speed aircraft has been announced by the Navy Department. At the same time an instrument to measure the speed of helicopters and other slow-moving aircraft was revealed.

The thermometer method was discovered by Dr. Theodore Shedlovsky, at the Rockefeller Institute, in connection with work in developing a way to measure true outside temperature during flight. Outside temperature strongly affects the readings of all the major aircraft instruments.

Dr. Shedlovsky mounted two thermometer "probes" in the air stream, one shielded and the other exposed to the full air flow, determining true temperature electrically by the difference in readings between the two probes.

Then he discovered that the difference in rise shown by the two probes is proportional to the square of the speed of the plane.

The slow-speed instrument was developed at the National Bureau of Standards. Its key is a set of light-weight anemometer cups mounted on practically frictionless bearings which start rotating in less than two knots of wind and give extremely accurate readings.

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PHYSIOLOGY-MICROSCOPY

Plastic Impressions Show How Blood Cells Look

See Front Cover

➤ RED BLOOD CELLS, human hair, fibers and a host of other things in the submicroscopic world can now have their "footprints" caught for study by a new film-plastic technique in combination with the electron microscope. The photograph on the front cover of this SCIENCE NEWS LETTER shows what red blood cells look like when magnified 13,000 diameters.

Scientists were baffled for a time in trying to make greatly magnified photographs of nylon fibers, sulfadiazine crystals and bacteria because they were too thick to be penetrated by either light waves or electrons. But now, just as FBI experts use moulage to preserve and study footprints of criminals, so the impressions of these submicroscopic objects can also be examined.

Little pressure is used in getting a plastic cast of these delicate materials that might easily be crushed beyond all recognition. The markings left by the specimen on the thermoplastic film are permanently recorded by depositing a thin film of silica upon it. It is the silica film that is actually photographed by the electron microscope.

The new technique was first used in studying the surfaces of fibers. The scales and fine markings found in replicas of wool fibers are those characteristic of all fur fibers. Replicas of nylon fibers show long grooves made by imperfections in the spinnerette through which the hot nylon plastic was forced in making the fiber.

How the replicas are made with simple equipment is told in a technical paper in the *Journal of Applied Physics* by Dr. R. Bowling Barnes, Charles J. Burton and Robert G. Scott of Stamford Research Laboratories, American Cyanamid Company.

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New *germicide materials*, known as quaternary ammonium compounds, destroy bacterial life within five minutes after exposure of the organisms to concentrations as low as one part in 20,000 parts of water.

ENGINEERING

Self-Guided Loran

May in the future guide ships and planes without human assistance on fixed courses. May also be developed to guide V-bombs.

➤ SHIPS AND PLANES of the future may be guided by Loran without human assistance and with no possibility of deviating from a fixed course, declared J. A. Pierce of Harvard University at the recent meeting of the Institute of Radio Engineers in New York City. He painted, also, an awe-inspiring picture of how Loran may be developed to guide pilotless aircraft and bombs in future warfare.

Loran is a wartime development of American scientists used with great success to guide military planes and ships straight to their targets and back again over vast expanses of land or water. It is similar to radar in its techniques, but differs in having the transmitters at fixed points on the ground along coast lines or on islands, and only receivers in the planes or ships.

The basic operation Loran performs is the determination of "lines of position," Mr. Pierce explained. This is done by measuring the relative time of arrival of two different pairs of radio pulses, which are known to have emanated from four fixed transmitters at times differing by a known interval, he said. The time difference of arrival is measured by the Loran receiver to a millionth of a second.

From this information, Mr. Pierce continued, the navigator can draw two curves which represent the lines of position. The point where these lines cross is the exact position of the plane or ship. The entire operation requires but a few minutes and is a big improvement over the age-old method of "shooting the stars" with a sextant, he asserted.

Mr. Pierce was head of the Loran division at Radiation Laboratory on the campus of the Massachusetts Institute of Technology during the war. He is now a fellow at Harvard's Cruft Laboratory, continuing research work on radio propagation.

Standard Loran now in use operates at several frequencies between 1700 and 2000 kilocycles, he stated, and radiates pulses twice as powerful as the largest United States broadcasting stations. In the daytime the device has a range of about 800 miles over water, but at night, by utilizing waves reflected from the upper portion of the earth's atmosphere, the range is about 1,600 miles.

The average error in using Loran is very small, he said, but a new technique still in the laboratory shows promise of radical reduction of even the present errors.

The development of receivers which will perform all functions automatically will be relatively simple, Mr. Pierce declared, and also of equipment that will trace on a chart a permanent record of the ship's movement. It is then but a short step, he added, to make "connection between the map and the rudder of a vessel so that a predetermined track may automatically be followed."

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ELECTRONICS

Power Lines Used For Telephone Service

➤ TELEPHONE service over rural electric lines bringing light and power to farm homes is under test in the area around Jonesboro, Ark., it is announced. In the new system, speech is transmitted by means of a carrier wave of radio frequency which travels on the power lines along with the power supply.

Electronic transmitting and receiving equipment is installed at the central switchboard and at each subscriber's end of the line. The dial instrument is used as in regular telephone service. Technical steps have been taken to prevent mutual interference between the two currents flowing on the same line. The power current has low frequency and high voltage, the telephone carrier current has high frequency and low voltage.

Steps have been taken, also, to eliminate reflections from branch lines, and to assure safety of users and maintenance men. The tests are encouraging, but the engineers in charge of the project point out that the new system is just emerging from the laboratory and that further experimentation is necessary before commercial application can be made.

This test installation is on power lines of the Rural Electrification Administration, with equipment in daily use by four telephone subscribers of the REA-financed Craighead Electric Cooperative Corporation. When the system is perfected it can be used to bring telephones to many of the nation's 2,750,000 farm families now served by power lines, but for many of which regular telephone lines are not available.

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OUR ANSWER—This non-metallic mine-detector located enemy mines made of clay, wood, glass and plastics. It consists essentially of an ultra-high-frequency radio wave transmitter and picks up both metallic and non-metallic mines at depths ranging from three to 12 inches. Official U. S. Army photograph.

ENGINEERING

Combination Gas and Oil Burner for Furnaces

➤ A BURNER for furnaces, in which either gas or oil can be used, and the switch from one to the other be made instantaneously, is offered by William A. Clements of Glendale, Calif., for patent 2,393,887. The same pipe and nozzle that blow in the gas inject a blast of high-pressure air when one valve-handle is turned. Opening another valve admits the oil. The air blast atomizes this into spray, which burns in a long, hot flame.

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Nearly 6,000,000 pounds of *sunflower seed* were grown in the United States in 1945 to produce table oils and animal feed.

DIRECTIONS: Read each Section carefully. The questions following each Section are based on the information given. In other words, the answers to the questions are dependent in some way on the materials of the Section to which they belong. Four possible answers are given for each question. Put an X in the answer box corresponding to the answer which you think is **most nearly correct.**

SECTION A: Special study of the heart rate of small birds and mammals has been made by means of the cardio-vibrometer. Because the heart rate is variable and such a sensitive "physiology-of-the-whole" indicator, it is necessary (1) to determine a basal rate or some sort of standard rate to serve as a basis for comparisons, and (2) to obtain quantitative data, that is, a large number of readings over sufficient time period to obtain a true measure of heart activity. To obtain a basal rate, muscular activity, food intake, temperature and cerebral activity (fear, excitement, etc.) must be controlled since, generally speaking, these have the most marked effects on the heart rate. Removal of the unpredictable effects of the conscious centers has been one of the chief difficulties in dealing with the heart rate in the past, but with the cardio-vibrometer this factor can be satisfactorily controlled even in wild species since the heart beat together with breathing and other movements is picked up indirectly, amplified, and recorded by a piezo-electric system. No electrodes are attached to the bird; it perches normally of its own volition, and need not be disturbed in any way during the experimental period. The use of a crystal-driven pen recorder facilitates obtaining a large number of accurate readings over long periods.

Disregarding age, sex, and seasonal variations, the average basal heart rates in round numbers of several species of birds are listed in the table, together with the maximum rates which were recorded immediately after flying, vigorous exercise, or excitement. The basal rates represent the average rates of the birds when at rest, in a post-absorptive but not starved condition (3-7 hours after last feeding for passerines, longer for larger birds or those with crops), in darkness, away from human presence, and at an air temperature at or slightly below thermal neutrality (about 30-32°C. for small birds).

AVERAGE BASAL HEART RATE (TIMES PER MINUTE) IN ROUND NUMBERS AND MAXIMUM HEART RATE

	Number of Individuals	Approx. wt. (gms.)	Basal rate	Maximum rate
Mourning Dove (Zenaidura macroura)	5	130	135	570
Towhee (Pipilo erythrophthalmus)	4	40	445	810
Cardinal (Richmondena cardinalis)	3	40	375	800
English Sparrow (Passer domesticus)	7	28	350	902
Song Sparrow (Melospiza melodia)	5	20	450	1,020
Canary (Serinus canarius)	10	16	514	1,000+?
Black capped Chickadee (Penthestes atricapillus)	14	12	480	1,000
Chipping Sparrow (Spizella passerina)	2	12	440	1,060
House Wren (Troglodytes aedon)	4	11	450	950
Ruby-Throated Hummingbird (Archilochus colubris)	2	4	615	?

QUESTIONS FOR SECTION A

51 Although the relationship is far from perfect, which is the most nearly correct statement regarding heart rate in small birds?
- ( ) 1. the size of species and heart rate are independent
- ( ) 2. the smaller the species, the less rapid the rate
- ( ) 3. the smaller the species, the more rapid the rate
- ( ) 4. the smallest species has the fastest maximum rate

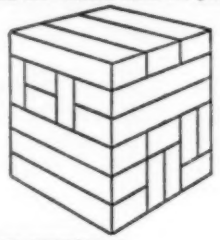
52 The word "passerines" refers to birds
- ( ) 1. at rest
- ( ) 2. like the sparrow
- ( ) 3. that migrate
- ( ) 4. without crops

PART B

53. A piezo-electric system has been used to
- ( ) 1. eliminate recordings of breathing
- ( ) 2. piece electrical discharges together
- ( ) 3. remove effects of conscious centers
- ( ) 4. vary an electric current by means of pressures

54. The heart rate of birds
- ( ) 1. is a maximum after flying or excitement
- ( ) 2. is a minimum at 30° to 32°C.
- ( ) 3. is doubled under conditions of exercise
- ( ) 4. must be measured in times per minute.

SECTION B: The 6-inch cube shown in the diagram is made up of pieces each 1 inch thick, 2 inches wide, and 6 inches long. Each block is painted in three colors, red, blue, and yellow according to its position as shown in the diagram. The top side of each block is red. The bottom side of each piece is blue, and the vertical sides are yellow.



QUESTIONS FOR SECTION B:

55. How many 1 x 2 x 6 blocks are there in the 6-inch cube?
- ( ) 1. 15
- ( ) 2. 18
- ( ) 3. 27
- ( ) 4. 36

56. How many square inches of block are painted blue?
- ( ) 1. 150
- ( ) 2. 180
- ( ) 3. 210
- ( ) 4. 256

57. What is the largest number of plane surfaces of other blocks touched by the plane surfaces of any one block?
- ( ) 1. 8
- ( ) 2. 11
- ( ) 3. 13
- ( ) 4. 15

58. How many square inches of blue surface are touching red surfaces?
- ( ) 1. 94
- ( ) 2. 108
- ( ) 3. 144
- ( ) 4. 196

59. Which arrangement of the blocks, forming a 6-inch cube, painted in the fashion described in the paragraph, would require the smallest possible area of yellow paint?
- ( ) 1. all blocks laid with a 2 x 6 side horizontal
- ( ) 2. all blocks laid with a 1 x 6 side horizontal
- ( ) 3. all blocks laid with a 1 x 2 end horizontal
- ( ) 4. the arrangement makes no difference

PART C

101 At 9:50 a.m. every morning a group of 100 factory workers (50 men and 50 women) stop work for 10 minutes and each drinks one cup (8 ounces) of hot coffee (44°C.). Between 10:00 and 10:30 their rate of output increases. What conclusion can you draw from this? *(Answer in less than 10 words.)*

102. A mariner is attempting to forecast the weather. He has available for ready reference accurate records of past fluctuations of wind, temperature, and humidity, and changes in cloud forms. He also knows what changes in weather accompanied them. He can predict the weather more accurately if he also has records available of past fluctuations of what? *(Answer in less than 10 words.)*

103 If each of N light waves (that is, all of the component simple waves making up a group of light waves) travels with the same velocity V, with what velocity will the N travel? *(Answer in less than 10 words.)*

104. A variety of different things are listed below in Column I. A variety of other things are listed in Column II, which are found in or derived from those in Column I. For each item in Column I, put the number of the appropriate item in Column II which is found in or derived from it.

Column I	Column II
( ) Adrenal glands	1. Acetylene
( ) Blood	2. Agglutinin
( ) Calcium carbide	3. Cortin
( ) Collagens (in vertebrate animals)	4. Ganglion
( ) Grain	5. Gelatin
( ) Mould	6. Helium
( ) Nerve tissue, nerve cells	7. Lignin
( ) Poppy	8. Opium
( ) Shale, coal, petroleum	9. Paraffin
( ) Uranium minerals	10. Penicillin
( ) Wood	11. Riboflavin

PART A

ONS: ...r possible answers are given for each ... Put an X in the answer box corresponding to ...er of the answer which you think is most nearly

...is the name of a plane figure formed by four straight lines bounding two obtuse and two acute ...?
1. diamond
2. pentagon
3. square
4. trapezoid

...of the following series does *not* contain the name ...achromatic color?
1. black, red, blue, yellow
2. orange, white, blue, green
3. red, yellow, brown, gray
4. red, blue, green, yellow

...one of the following metals is always in an ...am?
1. gold
2. tin
3. lead
4. mercury

...of the following is a chemical change?
1. magnetizing a rod of iron which weighs one kilogram
2. burning one pound of coal to determine its heat capacity
3. mixing flake graphite with oil
4. vaporizing one gram of mercury in a vacuum

...many half-inch squares would make an inch ...?
1. 2
2. 4
3. 8
4. 16

...gment cell, especially one capable of changes of ...or concentration of pigment, causing changes of ...in the skin" is called
1. chromatin
2. chromatophore
3. chromogen
4. chromoplast

...many half-inch cubes completely fill a hollow ...he inside of which measures an inch in length, ... and height?
1. 4
2. 8
3. 16
4. 32

...of the following may be said to be *poikilo-*...ic?
1. alligator
2. armadillo
3. opossum
4. ostrich

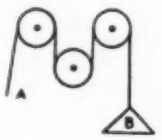
...ld theory of combustion was that it is a process ...ich substances give off phlogiston. The proof was ...ows. Some substances are seen to burn. Other ...nces will not burn. When a substance burns, ... ascends often with considerable force. Something ... to be escaping in the flame. This is named phlo... Substances which contain phlogiston will burn, ...ubstances which do not contain phlogiston will ...rn at all. The existence of phlogiston is further ...ned by the fact that the visible residuum of ... left after a substance is burned, is generally less, ...n weight and bulk, than the substance was before ... burned. This theory fails to take into account
1. ...ible weight of phlogiston
2. ...eous products of combustion
3. ...t of the burning
4. ...ght and bulk of ashes

8. A sphygmomanometer is a device used in the measurement of
( ) 1. auditory acuity
( ) 2. blood pressure
( ) 3. muscle tension
( ) 4. neural conductivity

10. A prefix meaning hardness is
( ) 1. hypo
( ) 2. macro
( ) 3. sclero
( ) 4. seismo

11. A decigram equals 1.5432 grains. How many grains are there in ten grams?
( ) 1. .15432
( ) 2. 1.5432
( ) 3. 15.432
( ) 4. 154.32

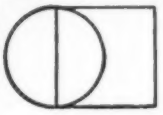
12. Through what minimum distance will rope A have to be pulled to raise weight B a distance of 1 meter? All pullies shown are in fixed positions.



( ) 1. ½ meter
( ) 2. ¼ meter
( ) 3. 1 meter
( ) 4. 2 meters

13. A solid all of whose plane surfaces are regular hexagons
( ) 1. does not exist
( ) 2. has 6 plane hexagonal facets
( ) 3. has 8 plane hexagonal facets
( ) 4. has 12 plane hexagonal facets

41. A circle of diameter d overlaps a square as shown in the diagram. If the area of a circle is π times the square of half the diameter, what is the area of the part of the square not in the circle?



( ) 1. $d^2 - \frac{\pi d^2}{2}$
( ) 2. $4d - 2\pi d^2$
( ) 3. $d^2\left(1 - \frac{\pi}{8}\right)$
( ) 4. $\pi d^2 - 4d$

42. Which figure best typifies the path traced by a point on the circumference of a wheel, the wheel rolling in a plane along a line in the plane?

( ) 1
( ) 2
( ) 3
( ) 4

43. *Paramorphism* is a term most likely to be used by which of the following?
( ) 1. a geologist
( ) 2. a mathematician
( ) 3. a serologist
( ) 4. a zoologist

TALENT TEST—These are sample questions from the Science Aptitude Examination, taken by 16,000 high school seniors. Only 3,000 were able to complete all the requirements, including this examination and an essay on "My Scientific Project." The 40 top winners have been invited to Washington March 1 to 5 to attend the Science Talent Institute and compete for the Westinghouse Science Scholarships, totaling $11,000.

GENERAL SCIENCE

Test Your Science Ability With These Questions

➤ HERE'S A SCIENCE aptitude test. Spend about 40 minutes taking it. You will then have some inkling of whether your own particular abilities include reasoning of the sort that scientists have to use. You won't necessarily be able to go out and solve problems in atomic energy, disease control, technology and other fields of physical and biological science so important today. But you will have some new insight into what it takes to be a scientist.

The questions on these pages are reproduced from the aptitude test of the Fifth Annual Science Talent Search. Thousands of boys and girls in their senior year in the nation's secondary schools took the full test as part of their entry in the search. Three hundred have been selected for honors and 40 are being invited to the Science Talent Institute at Washington, March 1-5, to compete for $11,000 in Westinghouse Science Scholarships.

Try these test questions on yourself or some friend. This is the way to do it. There are three kinds of questions.

Answer all questions in Part A by putting an X in the answer box corresponding to the number of the answer which is most nearly correct. In the case of Part B, first read each paragraph and then answer in a similar way each of the questions based on the information given. In Part C answer as directed.

Finish all the questions in one sitting and do not look at the answers printed elsewhere in the magazine until you are through.

The Science Aptitude Examination was made difficult purposely to eliminate those students who do not have the perseverance to finish a job, a prime requisite for a research scientist. Since no senior is required to take the test, any of these 14-to-18-year-olds were privileged to get up and leave after one look —and many did.

The test is only one of the techniques used in selecting boys and girls who are scientifically gifted. In addition each contestant filled out a personal data blank and wrote an essay describing some scientific project he has done or wishes to do. Teachers filled out a recommendation form and principals reported scholarship. All these are used in choosing winners.

Of the thousands of boys and girls who have taken the examination, not one made a perfect score. (*Turn to page 92*)

PSYCHIATRY

Prescription for Peace

Globalunacy can be avoided by curing national insanity. Only way of dealing with aggressive nations is through collaboration and agreements.

By MARJORIE VAN DE WATER

➤ THE MENTAL PATIENT who poses as Napoleon or God suffers from "delusions of grandeur" and we have no doubt that he is "crazy."

Nations suffer from the same sort of insanity. Germany under Hitler was one, Japan was another. For a good many years the governments claiming supreme sovereignty, or the king or emperor who claimed to be all powerful, have gotten away with it. But the world—and the scientists—are getting wise to such mental disorders of nations.

The mental patient with "delusions of grandeur" lands in a mental hospital—unless, like Hitler, he could succeed for a time in putting the idea over on his public.

In the nation, such delusions of power land a country in war.

Many other parallels between the behavior of nations and the warped attitudes and thinking that produce mental breakdown in the individual are found by Dr. Kenneth E. Appel, psychiatrist of the School of Medicine of the University of Pennsylvania.

Nobody loves a hermit or a dictator; they are nearly always considered a bit queer. To keep his mental health, a man must be able to get along reasonably well with other men at home, in business, in his social life. He has to be willing to sacrifice some of his own personal interests for the sake of keeping his friends.

It is much the same with nations. They, too, must give up a certain amount of "supreme sovereignty" to preserve peace in the world.

Important Problem

This is one of the most important problems facing the United Nations Assembly today—perhaps it is the most important.

In reality, every nation, no matter how powerful, is dependent upon other nations. Even in war, it is necessary to have allies. A reasonable cooperation with other countries in an international organization is necessary for the protection of mutual interests and the control of aggression in power-crazy nations.

Isolationism for the individual, Dr. Appel says, is a sort of mental suicide. For the nation it is "globalunacy." Dr. Appel, as a psychiatrist, has made a clinical study of this international insanity and has written a prescription.

The cause of a nervous breakdown, or neurosis, simply stated, is the feeling of helpless anger and futility that comes from trying vainly to apply the fixed habits and attitudes of childhood to the new situations of adult life. The child may overlearn his lesson when his mother teaches him that he must always be gentle, submissive and dependent on his parents' commands in the home. If the child does overlearn, he may find himself tragically unfit to face an adult world of business or war. If he cannot change to meet the new demands upon him, he will break.

New Ways of Thinking

Nations, too, Dr. Appel points out, face the necessity of developing new ways of thinking and dealing with other nations to fit the new conditions of a world containing the modern inventions of radio, the airplane, rocket, and the atomic bomb. If they fail to do this, the whole world faces catastrophe.

People are naturally conservative, he says; they feel more secure in following the "safe" old ways. And politicians and statesmen too often play upon this natural fear of the new and suspicion of the strange and foreign. The result is short-sighted isolationism and dangerous nationalism.

"New concepts, methods, and solutions must be developed to meet the new environment which modern technology has created for us," Dr. Appel declares in the *Journal of Abnormal and Social Psychology*. "Old methods will not solve new conditions. They lead to disaster with the individual, and with nations they lead to war.

"Modern technology has made us citizens of the world. Men at the opposite side of the earth are our neighbors. The airplane and the radio have made the traditional concepts of geographical borders antiquated. Borders and boundary lines should become administrative and cultural, not power concepts."

Isolationism in patients is always considered by physicians as an unhealthy sign. No one can keep his mental health if he hides from other people and lives within himself. To keep mental balance you need to be with other people, to share your experiences with them, to learn from them and laugh or weep with them. The person who lives completely alone is likely to lose his grip on reality. He may begin to see or hear things that are not there, to develop unreasonable suspiciousness and cantankerousness, to act "queer."

So it is, Dr. Appel says, with nations. Any country needs contact with others. They need interchange of raw materials and manufactured goods as well as cultural give and take. An attempt to keep others out and live alone in self-sufficiency breeds suspicions, aggressiveness, and delusions of national grandeur. A nation, like an individual, can get to be touchy and cranky and spoiling for a fight. It is not a healthy state—this attempt to persist in horse-and-buggy international relations in an atomic age.

It is not just the patient who has become "fixated" on childish habits of thinking and attitudes, or the schizophrenic who withdraws from human contacts to live in a dream-world within himself, who has parallels in the public life of nations.

There is also the maniac patient with exaggerated ideas of his own knowledge or power. You may be able to think of international incidents brought to mind by this young man's case:

He had been brought up in an indulgent atmosphere. Both money and affection were lavished upon him by his parents who encouraged him in the idea that he was an extraordinary person. He became thoroughly convinced of his own powers and believed himself adequate for any situation.

When the great depression descended upon the country, he was going to save the nation and the world. So he conceived a grandiose scheme of granting unlimited credit to business in this country and to unfavored nations throughout the world. Lavish spending was to go along with this unlimited credit—a point of view which, Dr. Appel says, has not been unknown in our own political life. To keep his imaginary "pot of gold at

PRESERVING THE PEACE—A psychiatrist who has studied the world's "globalunacy" prescribes international collaboration as the only protection against insane nations. Here U. S. delegates leave for the United Nations Assembly where this problem is one of the most serious being discussed. Photograph by Acme.

the end of the rainbow" always showering wealth and the good things of life on the people, it was only necessary, this man felt, to ask Congress for appropriate legislation. It doesn't take a psychiatrist to see the connection between this impractical view of life and the fact that in childhood he had always gotten everything he wanted simply by asking his parents to give it to him.

The Government, to this man, was just a benevolent, indulgent mother standing always ready to hand out bread and molasses.

This phantasy or delusion was indulged to such a degree that nurses and drugs had to be employed to prevent him from imposing these world-saving ideas on others, and to restrain anger that resulted when he met with refusal. Finally a guardian had to be appointed to conserve his financial resources, and he was hospitalized.

Children universally like fairy tales and the comic strips in which Cinderella and Superman can accomplish anything by means of magical powers given them by a fairy godmother or a uniform.

Adults, if they are normal, outgrow these ideas. As they gain strength, and competency, they learn to depend upon hard work and hard thinking instead of wishing to solve their problems. But those who are weak and incompetent do tend to cling to their childish ways. They may not actually cross their fingers, or wish on a star or carry a rabbit's foot, but they will still rely on asking favors of relatives and friends, or the church and the government. And they have a simple faith in the power of their own fantastic imaginings.

When statesmen have a similar disregard for reality and build grandiose schemes for a "new world order" in which they are going to conquer the world, wipe out whole peoples, control thought and establish themselves as supreme dictators, the insanity that results is costly not just to individuals but to the whole world.

How are such madmen and insane nations to be controlled? Dr. Appel has suggestions for this, too, drawn from his experience with mental patients.

"The only way of dealing with aggressive nations," he says, "is through realistic collaboration and agreements between other nations. This is collaboration and not isolationism."

And isolationism, Dr. Appel feels, can be overcome only when each nation faces realistically the actual limits of its own powers.

"The old idea," he says, "of sovereignty, namely, that no one can tell us what we must do or can do, that we are and will do what we please, is tragically refuted by the war. Actually, we cannot do just as we please.

"The old idea of sovereignty is much more represented by the realistic phrase, 'We will do what we can with existing limitations.' Practically, it has always been the latter, but we euphemistically and narcissistically use the former phrase when we are talking."

Freedom of individuals is always within limits provided by society. If a man imposes too much on the rights and interests of others, he will land in a court of law, in jail or in a mental hospital. If a nation imposes too much on the rights of other nations, it will land in war. Since other nations will usually band together against such aggression, the freedom of a dominating, power-crazed nation will ultimately be lost completely in defeat.

"Psychiatry teaches that only through the control involved in compromise and accommodation with his fellows can the individual achieve success and satisfaction—the same should apply to nations."

Science News Letter, February 9, 1946

Some varieties of *fungi* grow in bags created by themselves which, when full grown, burst to send thousands of spores floating through the air.

Some 30 firms in Belgium interested in the production of fuel or power are creating a scientific center to investigate the possibility of gasifying *coal* in the seam underground.

YOUR HAIR and Its Care

By Oscar L. Levin, M.D. and Howard T. Behrman, M.D.

NEW, REVISED, EXPANDED EDITION—JUST OUT!
If you want healthy hair, lovely hair, then you need the expert advice in this book.
Two medical specialists have here pooled their knowledge to give you in plain language the up-to-date scientific facts now available about hair. They tell you what to do to save and beautify your hair, stimulate healthier hair growth, and deal with many problems, common and uncommon, as:
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Do You Know?

Hydrogen cyanide is used to control parlatoria scale on olive trees.

Powdered dried red *blood cells* have been dusted on wounds to hasten healing.

Citrus fruit production in the United States increased seven-fold in the past 30 years.

Over 2,000,000 tons of fine *alloy steel* were used in the United States during the war to build airplane engines and airframes.

Dolomite found in northern Chile is said to be the only deposit in South America; it is of a good quality and is used to make hydraulic cement.

Scrap metal from partly completed military aircraft not needed by the Army because of the end of the war is being salvaged and sold; all usable equipment is first removed.

Shipbuilding consumed more steel during the war than any other single industry; of the more than 35,000,000 tons used in shipbuilding, approximately three-fifths went into merchant ships.

The lowly *coot*, or mudhen, might be called the "whitebill", it is suggested, to make this edible but unpopular fowl more acceptable on the dinner table; the coot is the third most plentiful waterfowl in America.

The name *"strawberry"* does not come from the common practice of using straw to mulch the plant, as many believe, but from the runners of the plant which at a certain season somewhat resemble scattered straws.

NEW "PICK-UP" CANE

Permits Disabled Persons to Pick Up Small Articles Without Painful Stooping.

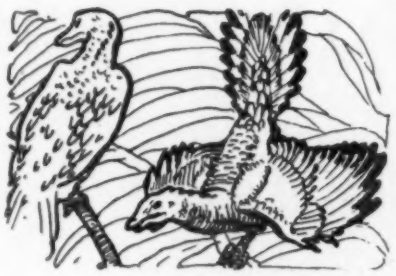
NO OTHER CANE LIKE IT

The Mason "Pick-Up" is a light double purpose cane with concealed patented pick up mechanism that enables the user by simple finger pressure and without any stooping to easily pick up papers, pencils, cards, coins, etc. Proper balance and rubber grip tip insures safer walking. Use a beautifully finished Mason "Pick-Up" Cane yourself or as a perfect gift for a disabled service man or friend. Write today for FREE CIRCULAR and 5 DAYS TRIAL OFFER.

W. H. MASON Box 27, Leesburgh, Ohio

EVOLUTION

NATURE RAMBLINGS by Frank Thone



Clothed for Coolness

➤ FEATHERS on birds and fur on beasts were evolved not to keep their wearers warm in a world that was growing colder but to enable the original, half-reptilian ancestors of present-day warm-blooded animals to stay out in the sun a little later in the forenoon without dying of heat-stroke. This theory, directly opposite to the one set forth in most zoology books, is offered by Prof. Raymond B. Cowles of the University of California at Los Angeles. (*Science*, Jan. 18).

The idea that feather and fur were developed to meet a need felt by their wearers strikes Prof. Cowles as a little too pat. It follows the Lamarckian line of reasoning, which seemed valid when first proposed, well over a hundred years ago, but which has been pretty well abandoned. New mutations, most biologists now believe, "just happen"—and if one of them by chance helps its possessor in the struggle for existence, that's *his* good luck. But mutations aren't made to order.

A mutation that resulted in the development of fur or feathers would prevent the glare of a hot sun from reaching the animal's skin and thus enable the wearer to keep on hunting food after the heat of the day had begun, Prof. Cowles suggests. This would have an obvious survival value. Of course, such a heat-insulating layer would work both ways, and when the climate took a change for the cooler a new kind of survival value would attach to it.

There is reason to suppose, Prof. Cowles argues, that warm-bloodedness in animals is of comparatively late evolutionary origin. An examination of all the higher vertebrate groups shows that the more recent, highly evolved members are also the warmest-blooded, while the more primitive types are nearer to the reptiles in the way their body temperatures react. Also, the young of some animals, especially nestling birds, are for a time less warm-blooded in their physiology than birds, and do not become completely warm-blooded until some time after hatching.

Science News Letter, February 9, 1946

From Page 89

When you try this selection of questions from the examination you should, therefore, not expect to find that you have checked all the right answers.

To save your time, only typical questions out of the original three-hour examination are reproduced on this page. You should be able to answer the 30 questions in about 40 minutes.

Don't read further. Cover up the following paragraph until you have taken the test.

The correct answers to part A are: *1*, 1; 2, 4; 3, 4; 4, 2; 5, 2; 9, 2; *10*, 3; *11*, 4; *12*, 3; 13, 1; 36, 2; 37, 2; 38, 1; 39, 2; *41*, 3; 42, 3; 43, 1. The right answers to Part B include: *51*, 3; 52, 2; 53, 4; 54, 1; 55, 2; 56, 2; 57, 2; 58, 3; 59, 4. In Part C, the correct answer to the first three questions can be any one of the following, or anything similar to it: *101*, none, no conclusion is possible, increased output due to chance, no conclusion without data from control group; *102*, barometric pressure; *103*, V, V velocity, velocity V, same velocity. The items in column I of question *104* should have the following numbers beside them in this order: 3, 2, 1, 5, 11, 10, 4, 8, 9, 6, 7.

If you answered correctly 22 of the questions, you did about as well as the average high school student completing the examination. Those of you who got only ten correct did no worse than some of the contestants with lowest scores. Anyone giving the proper answer to 27 of the questions probably is gifted in science. But remember, the questions given here are the easier ones included in the examination.

Science News Letter, February 9, 1946

Celery tops can be dehydrated and used as human food or feed for cattle.

Jack *pines* produce cones at an early age; as the trees grow older, woody tissues engulf the old cones along the main trunk and eventually completely entomb them in the trunk wood.

ENGINEERING

New Heating System

Chemical liquids which vaporize at high temperatures may replace water in home heating plants. Radiators may be warmed by high volatile liquid.

➤ HOME OWNERS who now rely upon water and steam to warm their radiators and baths may find chemical liquids which vaporize at high temperatures for future mediums for conveying heat in their houses.

Engineers convening in New York for the 52nd annual meeting of the American Society of Heating and Ventilating Engineers heard a report on developments in the domestic power field by Orion O. Oaks of the John B. Pierce Foundation. Experiments by the Foundation were begun early in the war in conjunction with the Office of Product Research and Development of the National Housing Agency with a liquid known at tetra-cresyl silicate. This liquid, which may be heated up to 817 degrees Fahrenheit without vaporizing, may well change domestic heating practice.

Two other chemicals are being experimented with for possible domestic application. They are Dowtherm A and Dowtherm E, products of the Dow Chemical Company, now used in industries concerned with molding plastic products, cooking varnishes, processing foods or other high temperature operations. Dowtherm A is a mixture of 73.5% diphenyl-oxide and 26.5% diphenyl. Dowtherm E has the chemical formula $C_6H_4Cl_2$ (inhibited orthodichlorbenzene). Use of such chemicals, while not new in industry, is new in domestic practice.

Using such "fluid heat" methods, a home could be powered from one source of heat. The independent power plants of the kitchen refrigerator, stove, dishwasher and washing machine might be eliminated. In their place would be a consolidated, single-fluid heating unit which would provide energy for every appliance, including the iron. Special tubing, instead of present electrical wiring, would carry the energy in the form of heat in the liquid around the house.

For use in home units a chemical such as tetra-cresyl silicate or Dowtherm must have high and controllable temperatures with relatively low pressures. Uniformity, non-toxic and non-poisonous characteristics are required. The liquid must have a boiling point many degrees higher than the highest working temperature and be of a permanent chemical structure. It must also be inactive toward materials used in fabrication.

Power and light are planned to be possible with installation of additional equipment. Success in this field would aid many farm communities and areas where power lines do not run. A saving of 48% in favor of liquid heat over anthracite coal is claimed by the Pierce Foundation in their experiments, and such savings would offset any added expenditures in installation of equipment.

Home unit are still in the development stage, according to Clarence W. Farrier, Technical Director of the National Housing Agency. One utility core unit consolidates the household heating, plumbing, electrical, bath, kitchen and laundry elements in a space no larger than a closet. Prefabricated, it can be rolled through the house framework during the building period.

This unit, being developed by the Ingersoll Division of the Borg-Warner Corp., could use fluid heat should application seem feasible. A unit known as the Grebe Plan, still in the development stage at the Dow Chemical, Midland, Michigan, plant, put all the kitchen and bath equipment in a U-shaped unit eight by 12 feet and about room height. The Pierce unit would operate any appliance that utilizes heat, including steam and hot water boilers.

Use of liquid heat would allow various equipment to be integrated into one unit so that piping connections and other parts, including actual appliances, could be factory installed. This would reduce the inefficiency of poor field connections and eliminate numerous separate installations. Continued developments promise great savings and added comfort for home owners of the future.

Science News Letter, February 9, 1946

CHEMISTRY

Ammonium Nitrate in Liquid Ammonia as Fuel

➤ A COMPLETELY revolutionary idea for fueling internal combustion engines is embodied in U. S. patent 2,393,594, issued to Dr. Clyde O. Davis, a chemist in the employ of E. I. du Pont de Nemours and Company, to which firm he has assigned rights in his invention.

Dr. Davis' proposal is to use as fuel a solution of ammonium nitrate in liquid anhydrous ammonia. Since ammonium nitrate contains oxygen which can be liberated and immediately recombined with the other elements, such an engine would need no outside source of oxygen, and could operate in the higher stratosphere, in submarines and in other places where air intakes present serious problems. Such an engine would be making use of the principle already successfully applied in guns and powder-propelled rockets; for powder also contains its own internal supply of oxygen, in the form of the nitrate atom-group.

An engine of this type should be non-fouling, for the elemental constituents of the fuel are gaseous at all except the very lowest temperatures. Moreover, since both ammonia and nitric acid can be made synthetically from constituents of air and water, such engines would be completely independent of a dwindling petroleum supply.

Science News Letter, February 9, 1946

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Absolutely no math background needed if you have the **PRACTICAL SLIDE RULE MANUAL** by J. M. Klock, Mathematician for the U. S. Navy and former instructor in the Detroit Public Evening Schools. An absolutely non-technical explanation of how to use a slide rule for the fundamental math calculations. **STUDENTS** of all math, science, and technical subjects will find the use of a slide rule to be a great aid in their work. **SHOP AND TECHNICIANS:** special applications made to formulae from mathematics, engineering, aeronautics, air navigation, etc. The slide rule gives rapid solutions to all the basic formulae. **OFFICE:** and business administration applications are numerous. The slide rule is especially valuable in per cent and interest work, and cost accounting. The booklet includes chapters on these subjects. The slide rule is also a valuable rapid estimator.

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• Books of the Week •

APPLIED ENERGY CONVERSION: A Text in Power Plant Engineering—Bernhardt G. A. Skrotzki and William A. Vopat—*McGraw,* 509 p., diagrs., and illus., $5. The equipment and economics of industrial and central station power plants and the coordination of equipment for the generation of energy from a physical and economic viewpoint.

THE BALANCE SHEET OF AGRICULTURE: 1945—U. S. Department of Agriculture, Bureau of Agricultural Economics—*Government Printing Office,* 44 p., charts and diagrs., 10 cents. The first of a series of annual reports whose purpose is to contribute to an understanding of the financial condition of agriculture viewed as a single industry.

BIBLIOGRAPHY OF INDONESIAN PEOPLES AND CULTURES — Raymond Kennedy—*Yale Univ. Press,* 212 p., maps, $2.50. Yale Anthropological Studies, Vol. 44.

BUILDING YOUR MARRIAGE—Evelyn Millis Duvall—*Public Affairs Committee,* 31 p., illus., 10 cents. A guide for newlyweds and other young people based on research findings by the National Conference on Family Relations, intended to supplement the counsel of family experts, clergymen, and physicians. Public Affairs Pamphlet No. 113.

A COMPARATIVE STUDY OF HUMAN REPRODUCTION—Clellan Stearns Ford—*Yale Univ. Press,* 111 p., $1.50. Yale University Publications in Anthropology No. 32.

DIAGNOSTIC PSYCHOLOGICAL TESTING—David Rapaport, Merton Gill, and Roy Schafer—*Year Book Publishing Co.,* 1088 p., 2 vol., tables, $6.50. The theory, statistical evaluation and diagnostic application of a battery of tests. The Menninger Clinic Monograph Series, No. 4.

ELECTRIC CIRCUITS AND MACHINES—An Introduction to Practical Electricity—Eugene C. Lister—*McGraw,* 358 p., diagrs. and illus., $3.50. An overall picture of the electrical field. The mathematics is limited to simple algebra.

THE EXPERIMENTAL HEALTH PROGRAM OF THE UNITED STATES DEPARTMENT OF AGRICULTURE—*Senate Committee on Education and Labor,* 166 p., charts, free. An analysis of the six experimental county-wide rural health programs located in counties in Texas, Georgia, Mississippi, New Mexico, Arkansas, and Nebraska.

ELECTRONS IN ACTION—James Stokley—*McGraw,* 320 p., diagrs. and illus., $3. An account of what electrons are and where they come from and discusses the elements and characteristics of electron tubes and their applications in the many fields of electronics.

EXPLORING OUR WORLD—Samuel Ralph Powers, Elsie Flint Neuner, Herbert Bascom Bruner, and John Hodgdon Bradley—*Ginn,* 522 p., illus., $1.44. Adventuring in Science, Book I. A text book in natural science for use in the grade school, fully illustrated and giving many suggestions for individual projects.

KEEPERS OF THE CORPORATE CONSCIENCE—Raymond W. Miller—*Island Press Cooperative,* 19 p., $1 paper, $1.50 cloth. A discussion of the public relations of the corporation in America.

MONOGRAPH OF THE FAMILY MORDELLIDAE (COLEOPTERA) OF NORTH AMERICA, NORTH OF MEXICO—Emil Liljeblad—*Univ. of Michigan Press,* 229 p., illus., $2. Miscellaneous Publications, Museum of Zoology, University of Michigan, No. 62.

PRACTICAL APPLIED ELECTRICITY—*Coyne Electrical School,* 7 vol., diagr., charts, illus., $19.75. For home study and reference use covering the entire field of electrical installation, operation and maintenance.

STATISTICAL METHODS—Applied to Experiments in Agriculture and Biology, by George W. Snedecor—*Iowa State College Press,* 485 p., charts, $4.50. 4th ed. This book aims to furnish the novice with a smoothly working combination of experimental data and statistical method.

SURFACE ACTIVE AGENTS—Theoretical Aspects and Applications—C. B. F. Young and K. W. Coons—*Chemical Publishing Co.,* 380 p., charts and illus., $6. Information about the origin, effects, and utilization of surface-tension phenomena in a diversity of industrial fields.

TWO-WAY RADIO—Samuel Freedman—*Ziff-Davis,* 506 p., diagrs. and illus., $5. The mechanics and applications of two-way radio for the different forms of fixed or postable communications are presented non-mathematically for users of such facilities.

WILEY TRIGONOMETRIC TABLES — *John Wiley,* 117 p., $1, 2nd ed. Ten trigonometric tables, to five places, including logarithmic tables, tables of powers and roots, S. and T. tables, frequently used constants, haversines and mils.

Science News Letter, February 9, 1946

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ASTRONOMY

American Astronomer Decorated by Mexico

➤ DR. HENRY NORRIS RUSSELL, director of Princeton Observatory, was decorated with the Order of the Aztec Eagle, Mexico's highest award to persons outside that country, by Dr. Espinosa de los Monteros, Mexico's Ambassador to the United States, at the dinner of the American Astronomical Society held in New York.

During the dinner, Sr. Luis Enrique Erro, director of the Mexican Astrophysical Observatory at Tonanzintla, Puebla, Mexico, presented a check for $1,000 to the Henry Norris Russell Lectureship Fund as a gift from Mexico's president, Manuel Avila Camacho, for the establishment of a lectureship honoring the Princeton astronomer. Dr. Harlow Shapley, president of the American Astronomical Society, received the check as chairman of the lectureship fund. Dr. Shapley, director of the Harvard Observatory, is also a member of the Order of the Aztec Eagle.

In decorating Dr. Russell, the Mexican Ambassador cited the American astronomer for his contributions to astronomical science and for his cooperation with Mexican astronomers and his interest in the Mexican people.

Science News Letter, February 9, 1946

Carbonyl iron powder, first made in this country in 1941, has unusual magnetic and electrical properties, it is claimed, that make it ideal for use in manufacturing electro-magnetic devices.

Several thousand tons of captured German and Japanese *synthetic oil* fuel plants and laboratories have been brought to America to be used in the synthetic liquid fuels research and development program.

GENERAL SCIENCE

Odd Questions Aided War

Far-travelled scientists and missionaries revealed important information about out-of-the-way lands to aid in winning the war. Answers were kept restricted.

➤ WHAT kind of hospital facilities and police systems are there on Greenland? Where is a man who can speak Fiji? Who can set up a child care program in Albania? How do you make snowshoes for horses? What is the origin and meaning of the name "Guadalcanal"? Where can we find a map of Copenhagen that shows art galleries and museums?

In order to answer such questions, the War and Navy Departments needed to know who had been where, how long, doing what. So more than 5,000 explorers, scientists and missionaries were rounded up to give specialized information required for winning the war, through the offices of the Ethnogeographic Board. This group of scientists was sponsored by the Smithsonian Institution, the National Research Council, the American Council of Learned Societies and the Social Science Research Council. The Board completed the final report and critical summary of its work, and went out of existence on Dec. 31.

According to its director, Dr. Henry Collins of the Smithsonian Institution, the Board answered hundreds of improbable questions for all the war-making agencies of the Government, ranging from information about the native process of making sago from sago palms, to requests for pictures and descriptions of Alaskan islands showing the terrain suitable for construction of air fields.

Aiming at promptness in answering these world-embracing questions, the list of 5,000 explorers was arranged by geographic area as well as alphabetically. Indexed under the name of an island in the Southwest Pacific, for instance, there might appear the names of a bird hunter, a shell collector, an anthropologist, an oil geologist and a missionary, with the dates of the days, weeks or years they had spent on the island, and the sort of things they would be likely to know about it.

If the Navy wanted to know about the beaches, the weather, or the language and trading habits of the natives on such an island, the staff of the Board looked on their cards for its name, found the names of the people who had been there, and looked for the answer in the books or articles written by the most likely one of them. If the answer wasn't there, the man himself was called upon, or written. Franked envelopes addressed to the Government office which had asked the question were enclosed to speed up answers, and also to reassure answerers that the question was official.

Once there came up certain strategic questions about one of the uninhabited Aleutian islands, which had been visited by only a few Americans in its history. Only one of these men was available, a man who had been there recently to study the habits of the sea otter and other animal life. The same day the question was asked, an Army officer flew from Washington to Wyoming to interview the sea-otter man, but not about sea otters.

For certain parts of the world, notably the Pacific islands, detailed information and lists of people were ready to use, also indexed by areas. Often the answers to odd questions were right on the cards, but the questioner was always given the source so that he could ask other questions if he wanted to.

At one important point in the progress of the war, a missionary was found who was able to supply much-needed photographs of the harbor of an enemy-held African city.

The Weather Bureau itself asked advice on how to get information on weather conditions in certain remote areas. The director of the Board furnished a sample of observations in Alaska from his own diary, and added a list of names of others who might have similar data on many parts of the world.

Now and then the Board had to answer a question by saying there was no information available, but most frequently the staff could call up someone and have the answer the same day. Some of the questions seemed trivial, but the answers were important enough to be kept restricted until the war was over.

Science News Letter, February 9, 1946

Transoceanic air traffic may increase *foreign pests* to American crops.

Niacin, used as a vitamin, is nicotinic acid, which derived its name from the fact that it was originally prepared by the oxidation of nicotine.

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Science News Letter, February 9, 1946

❁ *HOSPITAL TRAY for serving food to bed patients is made of a melamine plastic with an 18% addition of phenolic resin. It contains six deep separate compartments to hold different foods. It can be safely washed in boiling water, and it imparts no taste to foodstuffs served in it.*

Science News Letter, February 9, 1946

❁ *DAY-NIGHT distress signal gives from the same five-inch cylindrical container either a stream of orange smoke or a bright red flare. The smoke emits from one end, the flare from the other. To set off either, a paper cap is removed from the proper end, and a flip-ring pulled over the edge of the can.*

Science News Letter, February 9, 1946

❁ *FILMETER measures electronically the thickness of various coatings, which are electrically non-conductive, or non-magnetic metals such as aluminum and copper. The coatings may be paint, varnish, lacquer, ceramics or plastics. The heart of the apparatus is a battery-operated electronic beat-frequency oscillator.*

Science News Letter, February 9, 1946

❁ *RADAR UMBRELLA, a light portable unit developed especially for beachhead use, is used both as a reflector in sending out shortwave radio pulses and as a receiver to catch wave echoes reflected from enemy targets. The unit's rotating umbrella-like antenna is shown in the picture.*

Science News Letter, February 9, 1946

❁ *KNITTED toe mitt, just patented, may be worn either inside or outside the stocking when an open-toe shoe is used, to reduce the wear of the stocking. It has a closely woven silk edging that fits snugly around the base of the toes to hold the mitt in place.*

Science News Letter, February 9, 1946

❁ *POWDER for cleaning carpets without removal from the floor is used in solution and is applied by means of a rotary brush. It removes ordinary soil and also disinfects, deodorizes and demoths, all without injuring the texture or coloring of the carpet.*

Science News Letter, February 9, 1946

❁ *LOADING DEVICE to assist in putting heavy packages in an automobile rear trunk is a movable platform. It can be pulled out of the trunk into an accessible position behind the car by means of small rollers operating in channel tracks.*

Science News Letter, February 9, 1946

If you want more information on the new things described here, send a three-cent stamp to SCIENCE NEWS LETTER, 1719 N St., N. W., Washington 6, D. C., and ask for Gadget Bulletin 297.

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